ACCESSION #: 9109040364
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Susquehanna Steam Electric Station - PAGE: 1 OF 15
Unit 1

DOCKET NUMBER: 05000387

TITLE: Loss of Offsite AC Circuit Caused Unit Scram and MSIV Isolation
EVENT DATE: 07/31/91 LER #: 91-008-00 REPORT DATE: 08/30/91

OTHER FACILITIES INVOLVED: SSES - Unit 2 DOCKET NO: 05000388

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(i) and 50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

At 1034 hours on July 31, 1991, with Unit 1 and Unit 2 operating at 100% power, a RPS SCRAM and MSIV isolation occurred on Unit 1 when a switchyard fault detection relay mis-operated resulting in de-energization of one of Susquehanna's offsite AC circuits coincident with a pre-existing half-scram/half MSIV isolation signal condition. Unit 2 experienced a half-scram as a result of the loss of the offsite AC circuit. Both Units automatically responded to the transient as designed including an ECCS injection by the HPCI system and SRV actuations on Unit 1. Subsequent Unit 1 ESF actuations occurred: RPS logic actuations during control of reactor level and pressure by Operators; RWCU isolation during restoration; and automatic swap of HPCI suction supply on high suppression pool level. The following conditions prohibited by the plant's Technical Specifications occurred on Unit 1: A reactor level indicating switch was determined to have been inoperable in excess of the required LCO Action time; a reactor coolant sample could not be obtained

in the required time period; shutdown cooling was not established within 1 hour of meeting,the pressure permissive; and COLD SHUTDOWN was not achieved within 24 hours after entering Tech Spec 3.4.6.1 Action. Unit 1 was stabilized in accordance with the Emergency Operating procedures and brought to COLD SHUTDOWN. The half-scram condition on Unit 2 was reset. An Event Review Team performed root cause investigations for all transient and recovery related issues. Corrective actions include hardware replacement, procedure revisions, personnel training and a review of offsite power switchyard operation and communications relative to effects on Susquehanna operation. At no time were there any safety consequences or compromise to public health or safety.

END OF ABSTRACT

DESCRIPTION OF EVENT

At 1034 hours on July 31, 1991, with Unit 1 and Unit 2 operating at 100% power, loss of an offsite AC power circuit (EIIS Code: FK), coincident with a Unit 1 pre-existing half-scram/half Main Steam Isolation Valve (MSIV; EIIS Code: SB) isolation signal present, resulted in a Reactor Protection System (RPS; EIIS Code: JC) reactor SCRAM and MSIV isolation on Unit 1 and a RPS half-scram on Unit 2. The following describes the chronology of events and/or reportable conditions which preceded and ensued the SCRAM event:

JULY 31, 1991

07:55 The Unit 1 'B' Main Steam Line Radiation Monitor (EIIS Code: IL) failed. This resulted in a 'B' RPS (Division II) actuation (half-scram) and a MSIV B/D Logic isolation signal. No control rod movement or MSIV closure occurred which was per design.

10:34:03 PP&L fossil-fueled Montour Unit 1 was taken out of service to repair a boiler tube leak.

Upon opening of the Montour switchyard tie breaker from Montour Unit 1, a fault detection relay (Westinghouse Type KC4) in that remote switchyard misoperated. This caused the tripping of switchyard breakers (which normally maintain the 230 KV Montour-Mountain line energized to Susquehanna (SSES) Startup Transformer T-10 when Montour Unit 1 is off line) and de-energization of the Montour-Mountain 230 KV line. The Montour-Mountain 230 KV line is one of SSES's two required offsite AC circuits.

De-energization of the Montour-Mountain 230 KV line resulted in de-energization of SSES Startup Transformer T-10. De-energization of Transformer T-10 resulted in actuation of Unit 1 'A' RPS (Division I) and MSIV A/C isolation logic. With 'B' RPS half-scram and MSIV B/D isolation logic signals already present, a RPS SCRAM and MSIV isolation occurred. All control rods inserted fully. Operations implemented the applicable Emergency Operating Procedures (EOPs). All expected isolations and initiations occurred with the exception of the inboard suppression pool filter pump (EIIS Code: CG) suction valve which failed to close (the outboard valve did isolate closed).

On Unit 2, RPS 'A' (Division I) de-energized resulting in a half scram and containment isolations associated with the loss of the 'A' RPS power. All isolations and system initiations were verified to respond correctly and the half-scram was reset. Additionally, power was lost to Instrument AC (EIIS Code: EF) panels 2Y218/2Y219 following automatic transfer of Uninterruptible Power Supply (UPS) 2D240, which feeds 2Y218/2Y219, to its backup power supply. This resulted in loss of numerous instrumentation, control room indications and some plant support equipment.

10:34:18 (UNIT 1) The Reactor Recirculation Pumps (EIIS Code: AD) tripped per design.

10:34:39 (UNIT 1) Void collapse resulted in Reactor water level transient. The Reactor Core Isolation Cooling (RCIC; EIIS Code: BN) and High Pressure Coolant Injection (HPCI; EIIS Code: BJ) systems initiated and injected into the reactor vessel.

10:35:20 (UNIT 1) HPCI auto tripped on high reactor vessel water level (Level 8) per design. RCIC did not shut down automatically.

10:38 (UNIT 1) RCIC was manually tripped by the Operator. The 'E' Safety Relief Valve (SRV; EIIS Code: SB) cycled open and closed twice automatically to control reactor pressure.

10:41 (UNIT 1) Operations took manual control of Unit 1 SRV system to control reactor pressure and controlled level with RCIC (having been reset) in accordance with the EOPs. (Note: During the time from 1041 to 1723 on 7/31/91, three additional RPS actuations occurred while Operators were controlling level and

pressure with RCIC and SRVs, respectively. One RPS actuation occurred when the high reactor pressure setpoint (1037 psig) was reached; the other two actuations occurred when reactor vessel Level 3 (+13") was reached. Since all control rods were already fully inserted, no rod movement occurred.)

10:55 (UNIT 1) The 'A' Loop of residual Heat Removal (RHR; EIIS Code: BO) was placed in the Suppression Pool Cooling mode of operation to maintain suppression pool temperature within limits.

11:16 (Unit 1) Initial SCRAM was reset.

11:27 (UNIT 1) Reactor Vessel bottom head drain temperature exceeded Tech Spec 3.4.6.1 allowable maximum cooldown of 100 degrees F in any 1 hour period (actual of 108 degrees F in 48 minutes).

11:34 (UNIT 1) Startup Transformer T-10 was re-energized.

11:36 (UNIT 1) Main Condenser vacuum dropped below 19.7 inches HgA..

11:38 (UNIT 1) 'A' RPS was restored to its normal supply.

11:49 (UNIT 1) 'B' Loop of RHR was placed in Suppression Pool Cooling mode of operation to maintain pool temperature within limits.

11:56 (UNIT 1) Suction supply to HPCI auto-transferred from the Condensate Storage Tank (EIIS Code: KA) to the Suppression Pool on high (23'9") Suppression Pool level per design (ESF actuation).

12:14 (UNIT 1) Reactor Vessel Recirculation Loop temperatures exceeded Tech Spec 3.4.6.1 allowable maximum cooldown of 100 degrees F in any 1-hour period (actual - 'A' Loop 140 degrees F; 'B' Loop 146 degrees F).

13:10 (UNIT 1) While Operations was attempting to restore the Reactor Water Cleanup System (RWCU; EIIS Code: CE), the system auto isolated on high differential flow (ESF actuation).

17:30 (UNIT 1) Steam Seals (EIIS Code: TC) established via auxiliary steam. Condenser vacuum being re-established.

18:20 (UNIT 1) Began feeding Reactor vessel with Condensate system.

22:00 (UNIT 1) The 'B' Main Steam Line Radiation Monitor is restored.

23:15 (UNIT 1) The MSIVs are opened and the turbine bypass valves (EIIS Code: JI) are opened to continue decreasing reactor pressure.

AUGUST 1, 1991

03:15 (UNIT 1) RHR Shutdown Cooling permissive (98 psig) was reached.

11:23 (UNIT 1) Reactor water level was increased to 90 inches.

11:50 (UNIT 1) A reactor coolant sample for conductivity could not be obtained within a 4 hour period from the previous sample due to RWCU being isolated and too low a reactor pressure for alternate sampling. (This constituted an operation prohibited by Tech Spec 3.4.4)

18:30 (UNIT 1) RWCU pump placed in service.

21:55 (UNIT 1) RHR 'B' Loop was placed in Shutdown Cooling mode of operation. This was greater than 1 hour from the time the Shutdown Cooling permissive was met. (This constituted an operation prohibited by Tech Spec 3.4.9.1.)

AUGUST 2, 1991

01:30 (UNIT 1) Condition 4 was attained. This was greater than 24 hours from the time that LCO ACTION 3.4.6.1 was entered. (This constituted an operation prohibited by Tech Spec 3.4.6.1)

CAUSE OF EVENT

This section describes the cause for each of the reportable events/conditions contained in this LER.

UNIT 1 SCRAM/FULL MSIV ISOLATION AND UNIT 2 HALF-SCRAM

One of the required offsite AC circuits to Susquehanna Units 1 and 2 is via the Montour-Mountain 230 KV line which connects to Susquehanna through Startup Transformer T-10. At 1034 hours on July 31, 1991, PP&L fossil-fueled plant Montour Unit 1 was taken out of service to repair a boiler tube leak. Upon opening the Montour switchyard tie breaker to

Montour Unit 1, a fault detection relay (Westinghouse Type KC4) in that remote switchyard mis-operated. This caused the tripping of switchyard breakers which normally maintain the Montour-Mountain 230 KV line energized, resulting in de-energization of the line, and hence, Susquehanna Startup Transformer T-10.

De-energization of Transformer T-10 resulted in a loss of power, per design, to the Unit 1 and Unit 2 'A' Reactor Protection Systems (Division I) with a resultant loss of power to the MSIV A/C isolation logic on each unit.

With Unit 1 'B' RPS (Division II) half-scram and MSIV B/D isolation logic signals already present as a result of failure of the 'B' Main Steam Line Radiation Monitor earlier in the day, Unit 1 experienced a reactor SCRAM and full MSIV isolation.

Loss of power to the Unit 2 'A' RPS resulted in a half-scram and containment isolations associated with the loss of the 'A' RPS power.

The cause of mis-operation of the fault detection relay in the Montour switchyard was determined to be due to foreign material which wedged between the relay stator and rotor causing the relay to stick. Particles of black paint and metal chips were found inside the relay case. Switchyard breaker operation was proper in response to the false fault detection signal.

The cause of the failure of the Unit 1 'B' Main Steam Line Radiation Monitor was determined to be a random failure of a capacitor in the power supply to the monitor.

The cause of the failures of the Suppression Pool Filter Pump suction inboard isolation valve to close when expected and RCIC to trip when high vessel level (Level 8) was reached was attributed to an improperly installed instrument cover which resulted in mechanical binding, precluding switch actuation. The improper installation was caused by a manufacturing change in which the glass bezel was not glued into the retaining cover, as it had been previously. The glass indicating dial cover for level indicating switch LIS-B21-1N024A had been installed backwards when this switch was installed as a replacement on 5/2/91. Improper installation of the cover allowed the switch's indicating needle to bind against the glass. Needle movement is necessary for the trip contacts to actuate. Both the Suppression Pool Filter Pump suction inboard isolation valve and RCIC high level trip signals are from this instrument.

The cause of the loss of Instrument AC panels 2Y218/2Y219 on Unit 2 was attributed to failure of three battery cells in the backup power supply to Uninterruptible Power Supply (UPS) 2D240, which feeds 2Y218/2Y219. Upon the loss of Transformer T-10, normal AC power was lost to 2D240. 2D240 then automatically transferred to its self-contained battery bank backup power supply. However, due to the three failed cells, backup power was not available. It was determined that higher than expected ambient temperatures inside the UPS panel which houses the batteries shortened battery life. Nominal battery life was originally believed to be 10 years. However, based on operating history and higher ambient temperatures inside the UPS panel, the battery expected life is now known to be three years.

SUBSEQUENT UNIT 1 RPS ACTUATIONS

In accordance with the Emergency Operating procedures (EOPs), Operators were utilizing RCIC for level control and SRVs for pressure control following the SCRAM / MSIV isolation. These procedures direct Operators to maintain Reactor water level between +13 and +54 inches while maintaining Reactor pressure less than 1037 psig. Subsequent to reset of the SCRAM following the initial transient, the high reactor pressure scram setpoint (1037 psig) was reached once and the low reactor water level scram setpoint (+13") was reached ten times. Three of these signals resulted in actuations of the RPS due to the fact that the RPS had been reset three times after the initial event. The remaining signals resulted in alarm and indication only. Since all the control rods were already fully inserted, no rod movement as a result of the additional RPS initiations occurred. The cause of the additional scram signals was due to reactor vessel pressure and water level dynamic response as a result of the initial transient and the Operators' mitigation of the transient in accordance with the EOPs.

HPCI INJECTION TO VESSEL (UNIT 1)

A review of post scram data indicated that HPCI automatically initiated and injected into the reactor vessel for approximately 41 seconds before tripping on reactor vessel high water level (Level 8). The initiation occurred due to a level transient following the SCRAM/MSIV isolation.

The Operator was in the process of manually initiating RCIC in accordance with EOP guidance for RPV control and did not observe that HPCI had automatically initiated and injected to the vessel at the same time. The Operator did see the HPCI coast down following its trip on high reactor vessel water level approximately 41 seconds later.
A review of post scram data a few hours later concluded that HPCI had

injected to the vessel for approximately 41 seconds. A phone call to the Commission per 10CFR50.72(b)(iv) was made at that time (1510 hours on 7/31/91) but this exceeded the one-hour notification requirement from time of initiation/injection (10:34:39 hours on 7/31/91).

HPCI SUCTION SUPPLY AUTO TRANSFER FROM CONDENSATE STORAGE TANK TO
SUPPRESSION POOL (UNIT 1)

Normally, the HPCI pump draws a suction from the Condensate Storage Tank. However, if a low Condensate Storage Tank level (3' 7 1/2 ") or a high Suppression Pool water level (23' 9") occur, the HPCI suction supply will automatically transfer to the Suppression Pool. Prior to the Reactor Scram suppression pool water level was 23'-2". At 1156 hours on 7/31/91, the Suppression Pool water level increased to 23'-9" where the auto transfer to the Suppression Pool took place. The transfer operated properly, per design. The Suppression Pool level increase was primarily due to added inventory from SRVs being cycled open to control reactor pressure.

RWCU ISOLATION DURING SYSTEM RESTORATION (UNIT 1)

Following the SCRAM at 1034 hours on 7/31/91 until Operations attempted to restore the RWCU system at 1310 hours (about 2.5 hours elapsed time), temperature and pressure conditions in the RWCU system allowed flashing of the system inventory into the feedwater return lines. Voids in RWCU system piping then resulted which caused a high flow isolation upon the opening of suction and discharge valves. The voids resulted in a greater than 59 gpm flow while the system refilled, causing the valid high flow isolation of RWCU. RWCU System operation was per design. However, the procedure did not provide clear guidance to check saturation conditions in the RWCU loop and vessel pressure to ensure voiding had not occurred prior to restarting a RWCU pump.

SHUTDOWN COOLING NOT ESTABLISHED WITHIN 1 HOUR BY TECH SPEC ACTION
3.4.9.1.b (UNIT 1)

Following the loss of Transformer T-10 on 7/31/91, the Reactor scrammed, RWCU isolated and the Recirc Pumps tripped. Rapid cooldown of the Recirc Loops and loss of natural circulation in the vessel resulted in stratification conditions which precluded restart of the Recirc Pumps. The decision was made by Operations early into the transient not to restart Recirc Pumps, which would now be powered from Startup Bus 20 (the

other SSES offsite AC circuit) via a tie bus between Startup Buses 10 and 20. This decision was made due to concerns about the potential electrical transient effects on Unit 2, which was also trying to recover from the loss of T-10. By the time T-10 was restored, the temperature differential between the Recirc Loops and the reactor steam dome exceeded 50 degrees F in both loops, preventing startup of Recirc Pumps per Tech Spec 3.4.1.4. The stratification problem prevented placing RHR in Shutdown Cooling mode when the pressure permissive was met. The Operating Procedure prohibited placing RHR in Shutdown Cooling because of differential temperature limitations (less than 100 degrees F between the vessel steam dome and the bottom head drain and less than 100 degrees F between an idle Recirc Loop and the reactor vessel). There was no clear procedural guidance on how to proceed under these circumstances. Operations evaluated two alternatives:

1) Warming up the Recirc Loops using RWCU, or

2) Revising the operating procedure to permit startup of a RHR Loop in the Shutdown Cooling mode even though temperature requirements were not met.

Operations decided to restore RWCU rather than challenge the reactor coolant system with excessive heatup or cooldown stresses.

REACTOR SAMPLE FOR CONDUCTIVITY NOT OBTAINED AS REQUIRED BY TECH SPECS
(UNIT 1)

Tech Spec Surveillance Requirement 4.4.4.c requires an in-line conductivity measurement be obtained at least once per 4 hours in OPERATIONAL CONDITIONS 1,2 and 3 when the continuous recording conductivity monitor is inoperable. Samples were taken per Tech Spec requirements (every 4 hours) up to and including 0750 hours on 8/1/91. At 1150 hours on 8/1/91, following the SCRAM/MSIV isolation at 1034 hours on 7/31/91, a sample for conductivity measurement could not be obtained as required since the RWCU system was isolated, reactor pressure was low, RHR Shutdown Cooling was not in service and no suitable sample point existed as designed.

COLD SHUTDOWN (CONDITION 4) NOT ATTAINED WITHIN 24-HOURS AS REQUIRED BY
TECH SPEC ACTION 3.4.6.1

Due to not establishing RHR in the Shutdown Cooling mode after the

pressure permissive was met for the reasons described above, the requirement to be in Condition 4 within 24 hours was not satisfied when the ACTION statement of Tech Spec 3.4.6.1 could not be met. Condition 4 was not attained until 01:30 hours on 8/2/91. This exceeded 24 hours from time of entry into LCO 3.4.6.1 at 11:27 on 7/31/91.

REPORTABILITY/ANALYSIS

This section describes the basis for reportability and the analysis of each of the events contained in this LER.

UNIT 1 SCRAM/MSIV ISOLATION

These events were determined reportable per 10CFR50.73(a)(2)(iv) in that unplanned Engineered Safety Feature (ESF) actuations occurred when the, RPS initiated an automatic reactor SCRAM, per design, following a loss of power to RPS Division I coincident with a pre-existing half-scram condition on RPS Division II; and a MSIV closure, per design, following the loss of power to the MSIV A/C isolation logic coincident with a pre-existing MSIV B/D isolation logic signal present.

All control rods fully inserted. Maximum reactor pressure reached was 1057 psig. Minimum reactor level reached was -34 inches. All system initiations

and isolations occurred per design during the transient with the exception of the inboard Suppression Pool Filter Pump suction isolation valve which failed to close and failure of the RCIC turbine trip on subsequent high reactor vessel water level (Level 8). Both failures were caused by the binding of a single vessel water level indicating switch indicating needle at an intermediate position between the actuating setpoints for the valve closure and the RCIC turbine trip. The indicating needle was bound by the glass indicator dial cover which had been installed backwards when this instrument was installed as a replacement on May 2, 1991. The failure of this switch to function did not affect operation of the RPS since the redundant switch on the same RPS trip system functioned properly. The switch failure only affected the isolation logic for the Suppression Pool Filter Pump suction inboard isolation valve and the trip of RCIC at Level 8. The outboard isolation valve logic operated properly, accomplishing the isolation function for the Filter Pump suction line. The Operator manually tripped the RCIC system when it did not trip automatically on high reactor vessel water level (Level 8). In the unlikely event that the Operator did not manually trip RCIC, loss of RCIC and HPCI systems would eventually occur

when the main steam lines exiting the reactor vessel became flooded with water. The reactor vessel would then be depressurized to allow the use of low pressure systems for level control in accordance with the EOPs.

Closure of all MSIVs is an analyzed event in Chapter 15 of the Final Safety Analysis Report (FSAR). The plant was safely shut down and there were no radioactive releases recorded by effluent instrumentation. An engineering evaluation to determine the effects of the scram transient on the reactor coolant system structural integrity was performed. The evaluation concluded that the structural integrity was not compromised and the reactor coolant system remains acceptable for continued operation. The Emergency Operating procedures were properly implemented by Operations personnel and there were no safety consequences or compromise to public health or safety during the event.

UNIT 2 RPS DIVISION I ACTUATION (HALF-SCRAM)

This event was determined reportable per 10CFR50.73(a)(2)(iv) in that an unplanned ESF actuation occurred when power was lost to the RPS Division I, initiating a half-scram per design. There was no control rod movement and the unit continued to operate at 100% power. All isolations and system initiations were verified to respond correctly. Additionally, upon the loss of Transformer T-10, power was lost to Instrument AC panels 2Y218/2Y219 upon transfer of Uninterruptible Power Supply (UPS) 2D240 (which feeds 2Y218/2Y219) to its backup power supply (self-contained batteries). Due to three failed cells in the UPS battery bank, power was unavailable to Instrument AC panels 2Y218/2Y219 which resulted in the loss of numerous indications and instrumentation, as well as some plant support equipment. Operators utilized backup instrumentation and plant operation was not jeopardized. Two battery cells were expeditiously

replaced and the third was jumpered, restoring the 2D240 battery. All instrumentation and equipment was then returned to normal operation. At no time during the initiating event's impact on Unit 2 were there any safety consequences or compromise to public health or safety.

SUBSEQUENT UNIT 1 RPS ACTUATIONS

These events were determined reportable per 10CFR50.73(a)(2)(iv) in that unplanned ESF actuations occurred when the RPS logic actuated three additional times during response to the initial transient by Operations personnel. In accordance with the EOPs, Operators were utilizing RCIC for level control and SRVs for pressure control. One RPS logic actuation occurred when the high pressure scram setpoint (1037 psig) was reached

prior to opening an SRV. Two RPS logic actuations occurred when the low water level scram setpoint (Level 3, +13") was reached following closure of an SRV, due to the water level shrink. Since all control rods were fully inserted in the core, no control rod movement occurred. The RPS functioned per design and there were no safety consequences or compromise to public health or safety as a result of the additional Unit 1 RPS logic actuations.

HPCI INJECTION TO VESSEL (UNIT 1)

A review of post scram data confirmed that the HPCI system had automatically initiated following the SCRAM/MSIV isolation and had injected into the reactor vessel for approximately 41 seconds before tripping on reactor vessel high water level (Level 8). The Operator was in the process of manually initiating RCIC in accordance with EOP guidance and did not observe that HPCI had auto initiated and injected into the vessel at the same time. The Operator did see the HPCI system coast down following its trip on high reactor vessel water level. Following confirmation of post scram transient data, a phone call to the Commission per 10CFR50.72(b) (iv) was made (1510 hours on 7/31/91). This exceeded the one-hour notification requirement from time of initiation/injection (1034 hours on 7/31/91). There were no safety consequences or compromise to public health or safety as a result of this event.

A Special Report pursuant to Technical Specification 3.5.1 Action F. to describe circumstances of the actuation, total accumulated actuation cycles to date and the current value of the usage factor for the affected nozzle is being issued separately.

HPCI SUCTION SUPPLY AUTO TRANSFER FROM CONDENSATE STORAGE TANK TO
SUPPRESSION POOL (UNIT 1)

This event was determined reportable per 10CFR50.73(a)(2)(iv) in that an ESF actuation occurred when the HPCI suction supply automatically transferred from

the Condensate Storage Tank (CST) to the Suppression Pool, per design, when the Suppression Pool water level reached the transfer setpoint of 23'9". The Suppression Pool level increase was primarily due to added inventory from SRVs being cycled open to control reactor pressure. The automatic transfer operated properly and there were no safety consequences or compromise to public health or safety since the HPCI

system remained available for emergency core cooling if needed.

RWCU ISOLATION DURING SYSTEM RESTORATION (UNIT 1)

This event was determined reportable per 10CFR50.73(a)(2)(iv) in that an unplanned ESF actuation occurred when the RWCU system isolated on high flow during system restoration. Voids in RWCU piping, which had formed from inventory flashing due to the temperature and pressure conditions, resulted in a greater than 59 gpm flow while the system refilled. This caused the valid high flow isolation. There were no safety consequences or compromise to public health or safety since the RWCU system performed its intended function of containment isolation upon receipt of a high flow signal.

SHUTDOWN COOLING NOT ESTABLISHED WITHIN 1 HOUR AS REQUIRED BY TECH SPEC
ACTION 3.4.9.1.b (UNIT 1)

This event was determined reportable per 10CFR50.73(a)(2)(i)(B) in that when the RHR shutdown cooling permissive setpoint was reached (0315 hours on 8/1/91), no RHR Shutdown Cooling Loop nor alternate method of reactor coolant circulation was established within one hour, as required by Technical Specification ACTION 3.4.9.1.b. This represented a condition prohibited by the plant's Technical Specifications.

Following the loss of Transformer T-10 on 7/31/91, the reactor scrammed, RWCU isolated and the Recirc Pumps tripped. Rapid cooldown of the Recirc Loops and loss of natural circulation in the vessel resulted in statification conditions which precluded restart of the Recirc Pumps. The decision was made by Operations early into the transient not to restart Recirc Pumps due to concerns about electrical transient potential effects on Unit 2, which was also trying to recover form the loss of T-10. By the time T-10 was restored, the temperature differential between the Recirc Loops and the reactor steam dome exceeded 50 degrees F in both loops, preventing startup of Recirc Pumps per Tech Spec 3.4.1.4. The stratification problem prevented placing RHR in Shutdown Cooling mode when the pressure permissive was met because of differential temperature limitations in the operating procedure (less than 100 degrees F between the vessel steam dome and the bottom head drain; and less than 100 degrees F between an idle Recirc Loop and the reactor vessel). There was no clear procedural guidance on how to proceed under these circumstances. Operations evaluated two alternatives:

1) Warming up the Recirc Loops using RWCU, or

2) Revising the operating procedure to permit startup of a RHR Loop in Shutdown Cooling mode even though temperature requirements were not met.

Operations decided to restore RWCU rather than challenge the reactor coolant system with excessive heatup or cooldown stresses.

Reactor pressure and level were under control and temperatures were decreasing throughout the period from 0415 hours on 8/1/91 to 2155 hours on 8/1/91, when Shutdown Cooling was established. There were several systems available for control of reactor pressure, temperature and level. The decision to restore RWCU and slowly heat up the vessel Recirc lines was a conservative one that minimized the heatup and cooldown transients on the vessel and connected piping. All low pressure ECCS systems were available throughout the event. As such, there were no safety consequences or compromise to public health or safety as a result of this condition.

REACTOR SAMPLE FOR CONDUCTIVITY NOT OBTAINED AS REQUIRED BY TECH SPECS
(UNIT 1)

This event was determined reportable per 10CFR50.73(a)(2)(i)(B) in that a sample for reactor coolant conductivity measurement could not be obtained within 4 hours of the previous sample (while in Condition 3) per Technical Specification Surveillance Requirement 4.4.4.c. This represented a condition prohibited by the plant's Technical Specifications. Samples had been taken per Tech Spec requirements up to and including 0750 hours on 8/1/91. At 1150 hours on 8/1/91, following the SCRAM/MSIV isolation at 1034 hours on 7/31/91, a reactor coolant sample for conductivity measurement could not be obtained as required since the RWCU system was isolated, reactor pressure was low and no suitable sample point existed. Following restoration of RWCU flow at 1830 hours on 8/1/91, sampling for conductivity measurement was resumed.

Based on samples obtained prior to and following the approximate 10 hour 40 minute period in which no sampling occurred, conductivity excursions within the reactor coolant system were extremely unlikely. As such, there were no safety consequences or compromise to public health or safety as a result of this condition.

COLD SHUTDOWN (CONDITION 4) NOT ATTAINED WITHIN 24 HOURS A REQUIRED BY
TECH SPEC ACTION 3.4.6 (UNIT 1)

This event was determined reportable per 10CFR50.73(a)(2)(i)(B) in that the plant did not enter COLD SHUTDOWN (Condition 4) within 24 hours as required by Technical Specification ACTION 3.4.6.1 after entry into that LCO ACTION. The paragraphs above, which describe why Shutdown Cooling was not established within one hour after the RHR Shutdown Cooling permissive was met, also apply to why COLD SHUTDOWN was not achieved within 24 hours following entry into Tech Spec ACTION 3.4.6.1 at 1127 hours on 7/31/91. COLD SHUTDOWN was reached at 0130 hours on 8/2/91. The reactor was stable and under control of the

Operators throughout the period from 1127 on 8/1/91 to 0130 on 8/2/91. All low pressure ECCS systems were available throughout this period. As such, there were no safety consequences or compromise to public health or safety as a result of this condition.

LEVEL SWITCH LIS-B21-1N024A FOUND INOPERABLE - EXCEEDED TECH SPEC LCO
3.3.1.a ACTION TIME (UNIT 1)

This event was determined reportable per 10CFR50.73(a)(2)(i)(B) in that level switch LIS-B21-1N024A, which provides a low reactor water level (Level 3) trip signal to the RPS (as well as containment isolation valve and RCIC high level trip signals), was found disabled due to an apparent intermittent mechanical interference introduced during installation on 5/2/91. Since the investigation was able to ascertain when the mechanical interference was introduced, the switch was assumed to have been inoperable from that time, thus exceeding the LCO ACTION time required by Tech Spec ACTION 3.3.1.a (inoperable trip system to be placed in the tripped condition within 1 hour). This was a condition prohibited by the plant's Technical Specifications.

Following the SCRAM on 7/31/91, it was observed that the Suppression Pool Filter Pump suction inboard isolation valve failed to isolate on low reactor water level (Level 3; 13"). The valve isolation logic required that both the A and B level switches (LIS-B21-1N024A and B) actuate. Also, during the same transient, the RCIC system failed to trip on high reactor vessel water level (Level 8; 54"). The trip logic for this function requires that both the A and C instruments actuate.

The indicating needle on switch LIS-B21-1N024A was found to be mechanically bound by the glass indicator dial cover which had been installed backwards when this instrument was installed as a replacement on 5/2/91. Needle movement is necessary for the trip contacts to activate.

The condition of the switch did not affect the operation of the RPS, since the other switch on the same trip system functioned properly. For the valve isolation function, only the inboard Suppression Pool Filter Pump suction isolation valve was affected. The outboard valve operated properly, accomplishing the isolation function. The Operator manually tripped the RCIC system when it did not trip automatically on high reactor vessel water level (Level 8). In the unlikely event that the Operator did not manually trip RCIC, loss of RCIC and HPCI would eventually occur when the main steam lines exiting the reactor vessel would become flooded with water. The reactor vessel would then be depressurized to allow the use of low pressure systems for level control in accordance with the EOPs. This would not result in a seriously degraded condition nor is it outside the plant design basis. As such, there were no safety consequences or compromise to public health or safety as a result of this event.

CORRECTIVE ACTIONS

UNIT 1 SCRAM/MSIV ISOLATION AND UNIT 2 HALF-SCRAM

Immediate corrective actions consisted of initiating a SCRAM recovery on Unit 1, recovering from the effects of the half-scram on Unit 2 and placing Unit 1 in a COLD SHUTDOWN condition. An Event Review Team was formed to address all issues related to the transient and its recovery, including additional balance-of-plant system support issues such as auxiliary steam system capacity and capability relative to re-establishing steam seals and condenser vacuum.

The Montour Switchyard fault detection relay which had mis-operated was replaced and functionally tested satisfactorily.

The failed capacitor in the Unit 1 'B' Main Steam Line Radiation Monitor power supply was replaced, functionally retested and returned to OPERABLE status.

As a followup action to this event, switchyard operation and communications relative to switchyard operations with the potential to affect Susquehanna SES operation will be reviewed during the next Bulk Power Maintenance and Planning Meeting. This review will be completed by October 31, 1991.

The level indicating switch glass cover which mechanically bound the indicating needle and, hence, precluded switch operation, was properly

re-installed and the switch was returned to operable status. All similar switches on Unit 1 and Unit 2 were inspected. One Unit 2 pressure indicating switch, PIS-B31-2N018A, was found to have its glass cover installed backwards. However, sufficient clearance was observed to exist between the glass cover and the indicating needle. Thus, this switch's operability was not affected. This switch's cover was also correctly re-installed. The Instrument and Controls (I&C) Section is reviewing this incident with all I&C personnel. Additionally, the I&C Training Instruction for calibration/installation of this type instrument will be revised to note proper installation of the glass cover. This revision will be completed by October 31, 1991.

Immediately after the failure of the three UPS battery cells on Unit 2, which caused loss of Instrument AC panels 2Y218/2Y219, two cells were replaced and the third was jumpered in UPS panel 2D240 in order to restore power. After recovery from the transient, all similar UPS batteries were replaced in their entirety on Unit 1 and Unit 2 (except one battery bank which had been replaced four months earlier). Since the evaluation concluded that the higher than expected ambient temperatures in the UPS panels require a derate of battery service life, procedures have been changed to require increased battery maintenance and surveillance, including changeout of batteries at a frequency not to exceed every other Unit operating cycle and performance of a semi-annual inspection and load test of each UPS battery.

HPCI INJECTION TO VESSEL NOT REPORTED WITHIN REQUIRED TIME (UNIT 1)

A review of transient data was performed and it was concluded that HPCI had automatically initiated and injected to the reactor vessel for approximately 41 seconds at 1034 hours on 7/31/91. A phone call was made to the Commission at, 1510 hours on 7/31/91 following confirmation of data. Training will be conducted relative to enhanced awareness of ECCS initiations and reporting requirements during transients of this nature for all licensed operators and Shift Technical Advisors. This training will be completed by October 31, 1991.

RWCU ISOLATION DURING SYSTEM RESTORATION (UNIT 1)

The operating procedure for RWCU System is being revised to provide clear guidance to check saturation conditions in the RWCU loop and reactor pressure to ensure voiding has not occurred prior to restarting a RWCU pump following automatic isolation. This revision will include steps to determine if the system can be restored without prior venting and, if

determined that venting is required, will include all steps required to properly vent the system. The revision will also address restoration after the system has been isolated and drained or allowed to cool well below reactor vessel temperature. This revision will be completed by October 31, 1991.

SHUTDOWN COOLING NOT ESTABLISHED WITHIN 1 HOUR AS REQUIRED BY TECH SPEC
ACTION 3.4.9.1.b and COLD SHUTDOWN NOT ACHIEVED WITHIN REQUIRED TIME OF
TECH SPEC ACTION 3.4.6.1.b (UNIT 1)

Once RWCU flow was restored (at 1830 hours on 8/1/91), the temperatures in the Recirc Loops were raised and RHR Shutdown Cooling was established at 2155 hours on 8/1/91. COLD SHUTDOWN (Condition 4) was achieved at 0130 hours on 8/2/91. An engineering evaluation was performed to determine effects of the transient on the reactor coolant system and concluded that its structural integrity was not compromised and the system remains acceptable for continued operation.

PP&L is continuing to pursue resolution with NRC NRR of the issues involving heatup and cooldown rates of the reactor vessel and associated piping of the reactor coolant system. This item is being tracked by NRC Unresolved Item Docket No. 50-387 / 89-01-02.

ADDITIONAL INFORMATION

Failed Components Identification: None identified. There have been previous reported events involving plant transients due to loss of Startup Transformer T-10 and previous reported events involving MSIV isolations. However, this incident was unique in that the loss of T-10, coincident with a pre-existing half-scram/half-MSIV isolation signal on Unit 1, resulted in a RPS SCRAM and MSIV isolation of Unit 1 (and a half-scram on Unit 2).

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August 30, 1991

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SUSQUEHANNA STEAM ELECTRIC STATION
LICENSEE EVENT REPORT 91-008-00
FILE R41-2
PLAS - 497

Docket No. 50-387
License No. NPF-14

Attached is Licensee Event Report 91-008-00. This event was determined reportable per 10CFR50.73(a)(2)(iv) in that Susquehanna Unit 1 experienced unplanned actuations of Engineered Safety Features (ESF) during and following a Reactor Protection System (RPS) scram and Main Steam Isolation Valve isolation; and Unit 2 experienced an unplanned automatic ESF actuation when a RPS half-scram occurred. The initiating event for both units' ESF actuations was mis-operation of a remote switchyard fault detection relay resulting in loss of an offsite AC power circuit. This document also reports,per 10CFR50.73(a)(2)(i)(B), several conditions prohibited by the plant's Technical Specifications which occurred on Unit 1 during recovery from the initial transient.

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RRW/mjm

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